Cruise Mobile Apps

2022 Annual Report

sourcetoad

Contents

Introduction

This year's App Report has been the most challenging year of analysis due to the application packaging systems that are becoming more and more common throughout the industry. To explain the packaging systems, we first need to explain the numerous features that every mobile app requires, even if the user never needs them. For example, an Android application requires a build that will work on Samsung tablets in Spanish and Pixel phones in Mandarin. Up until recently, every user has been required to download application packages that include multiple language and platform types in a unified bundle.

Both Android and iOS have now provided build tools for developers that allow them to dynamically create multiple versions of their software. These additional software versions can include different combinations of features, languages, and platforms that their users may require. This allows for smaller download sizes of apps and increased efficiency.

However, these changes have made life harder on our analysts. Our survey exclusively investigated one platform in only one language (English). The outcomes can be assumed to be representative of all other builds, but there is no longer enough time to economically investigate every package available for every app.

As a caveat, it does appear that the packaging complexity is still largely confined to the native applications in this survey. The increasing number of cross-platform applications seem to have spent less time in modularizing their code bases. As a result, this survey is still extremely relevant and offers numerous insights into the features and trends arising in the cruise mobile app world.

2022 has been a very busy year for app developers in the industry. A large number of new features and libraries have been added. Development is clearly back on the table after a Covid slowdown, and the future looks bright for innovation in the field.

> If you would like your app or a feature included in the next report, please contact us at **appreport@sourcetoad.com**.
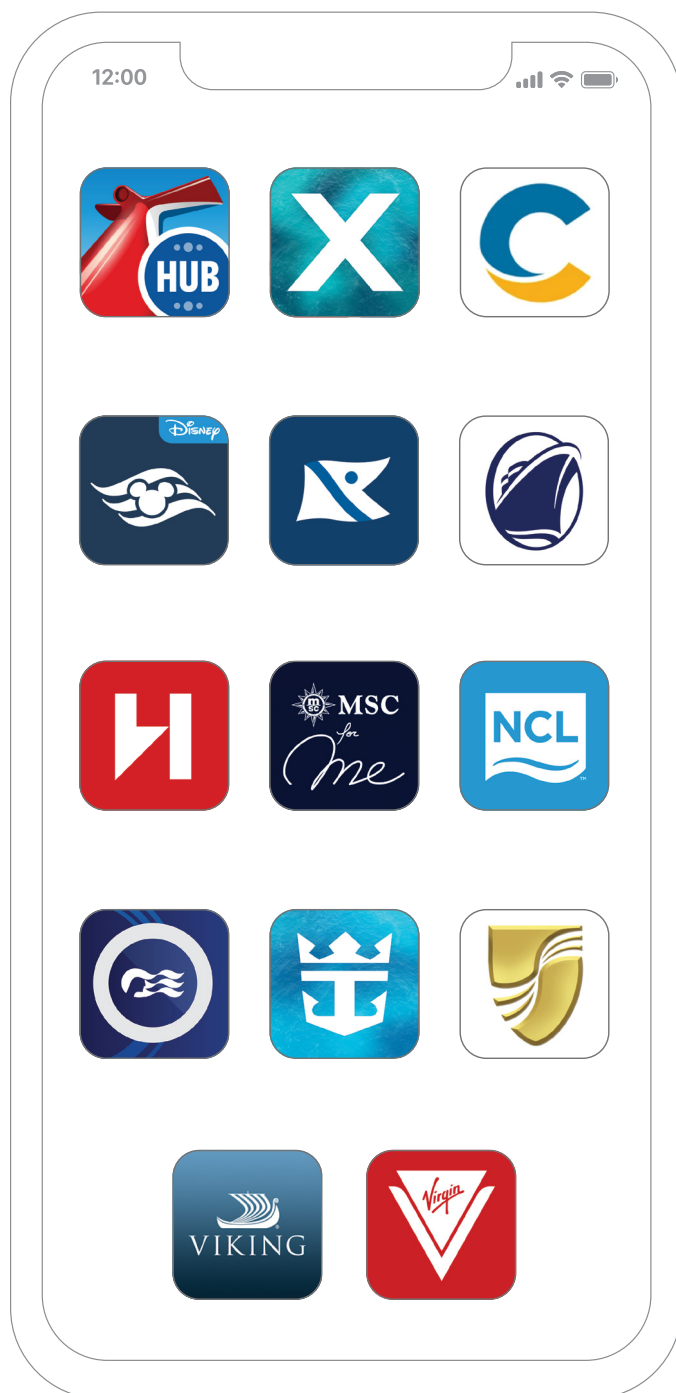
New	A new addition to the 2022 report.
Updated	A significantly updated section.

Mobile Applications

Carnival Cruise Line

Carnival HUB was released in January 2015 and works across the cruise line's entire fleet.

Celebrity Cruises

Celebrity Cruises was released in November 2017. The app now works on eight ships in Celebrity's fleet (*Apex, Constellation, Edge, Equinox, Millennium, Reflection, Silhouette,* and *Summit*), with features varying by ship. The app appears to share much of the same code base as the Royal Caribbean International and Azamara apps.

Costa Cruises

Released in January 2018, *Costa Cruises* works across the cruise line's whole fleet.

Disney Cruise Line

Disney Cruise Line Navigator has been around since August 2013, but it was redesigned in February 2018. It works across all four of Disney's ships.

Fred. Olsen   `New`

Fred. Olsen Cruise Companion works across the cruise line's entire fleet of ships. The app was released in 2019.

Holland America

In February 2019, Holland America Line released a downloadable mobile version of their *Navigator* web app. *Holland America Line Navigator* works across the cruise line's entire fleet. The app shares a code base with *Seabourn Source*.

Hurtigruten New

Hurtigruten's on-board app works on two ships in the fleet (*MS Amundsen* and *MS Fridtjof Nansen*). The app was released in 2019.

MSC

MSC for Me works on six ships in MSC's fleet (*Bellissima*, *Grandiosa*, *Meraviglia*, *Seaside*, *Seaview* and *Splendida*). The app went live in June 2017.

Norwegian Cruise Line

Cruise Norwegian was released in October 2017 and now works on all ships in the fleet.

Princess

Princess Cruises originally released *MedallionClass* in August of 2019. The line recently rolled out the app across its whole fleet.

Royal Caribbean International

Royal Caribbean International became available for download in November 2017 and now works on 20 ships in the fleet (*Adventure, Allure, Anthem, Brilliance, Enchantment, Freedom, Harmony, Independence, Liberty, Mariner, Navigator, Oasis, Ovation, Quantum, Rhapsody, Serenade, Spectrum, Symphony, Vision,* and *Voyager*). As mentioned before, this app shares much of the same code base as the *Celebrity Cruises* and *Azamara* apps.

Seabourn Source

Seabourn Source was released in April 2020 and works across the cruise line's whole fleet. The app shares a code base with *Holland America Line Navigator*.

Viking Ocean Cruises

Viking Voyager was released in June 2017 and works across the cruise line's entire ocean fleet.

Virgin Voyages New

The Virgin Voyages Sailor app went live in 2021 and works on all three ships in Virgin's fleet.

‹	**ACTIVITIES**	☰

MONDAY, MAY 3

| 9:00a.m.	Breakfast of Champions Dining Hall III
9:30 a.m.	Pamper Day Spa
10:00 a.m.	Music by the Pool Pool Deck II
10:30 a.m.	Godzilla vs. Kong Movie Theater
11:00 a.m.	Story Time Kids Corner
12:00 p.m.	The Lay of the Land Main Conference Hall
12:00 p.m.	Dancing with the Stars Stage I
12:30 p.m.	Captain's Lunch Banquet Hall
1:00 p.m.	Water Wars

Availability

Supports mobile app onboard · Does not support mobile app onboard

Features

Each app that we analyzed contained a fairly broad selection of features and options. To better compare and contrast their offerings, we broke down the features into categories: Common (almost all apps have this feature), Less Common (appearing in at least three but no more than half of the apps), and Stand-out (found in only one or two apps).
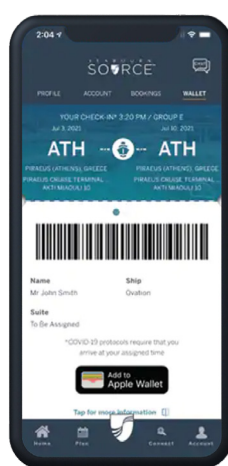
Common Features *Updated*

There are several features shared by the majority of the apps we reviewed.
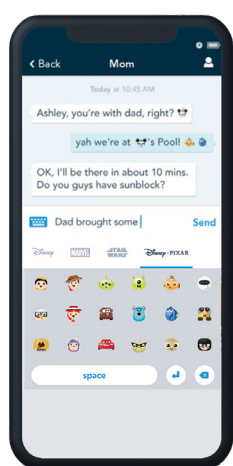

Chat

Chat has now been adopted by the majority of the apps we reviewed, and most are free. Despite the chat feature's ubiquity, passenger reviews reveal inconsistent performance of what many now feel is an essential feature.

Check-in

One of the features that has been rolled out for most apps is pre-board document management, check-in, and digital boarding passes, to help passengers onboard more quickly.
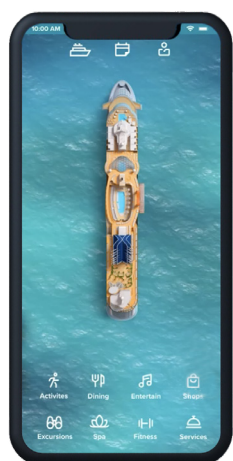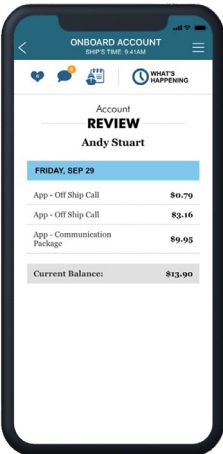

Deck Map

Deck plans are a ubiquitous feature and a critical guide for guests to navigate around cruise ships.


Dining

Every app has at least some information on dining options. Dining features across applications include hours, menus, images, locations, dress attire, and (in most cases) reservation management.
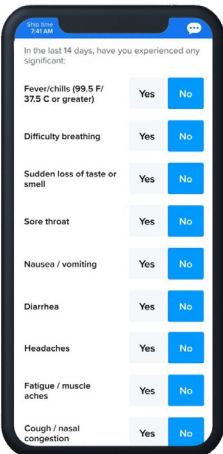
Folio

The folio is an itemized billing statement that updates when expenses are added to a user's account. This feature allows passengers to view all charges to their account, regardless of who makes them.
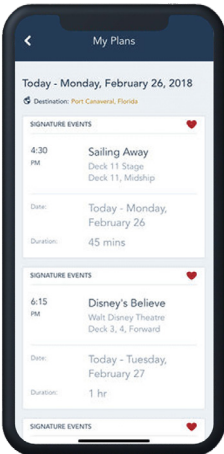
Itinerary

The itinerary is the guest's customized schedule. Once an activity has been favorited or booked, it appears on this calendar.

Health Questionnaires

Almost every app features health questionnaires, and an increasing number of apps allow passengers to upload COVID-19 vaccination records to help streamline check-in on cruises where proof of vaccination is mandatory.
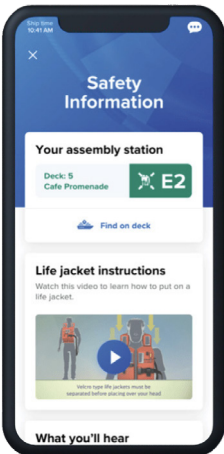
Muster

Most cruise lines now present safety information via video (on stateroom TVs or mobile devices) and only require guests check-in to their assembly station prior to departure, eliminating traditional large-group assemblies.
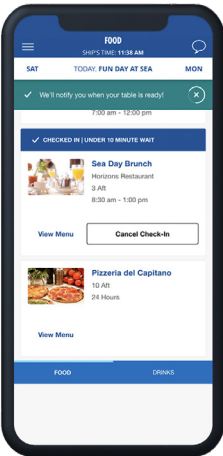
Notifications New

Most apps feature push notifications to remind or update passengers on their booked events, dining, spa and entertainment reservations, excursions, folio changes, and chat messages.
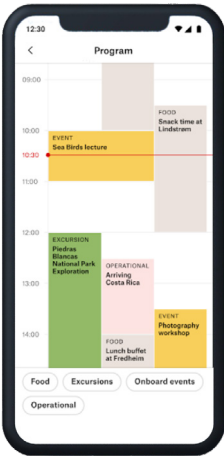
Schedule

The daily schedule is the main stop when planning activities for each day. An event can usually be added, booked, or marked. It then moves to the itinerary.

Shore Excursions

The vast majority of mobile applications we reviewed allow guests to both research and book an excursion. Less common is the ability for guests to do so shoreside, prior to departure.

Spa Services

Most cruise lines offer some level of spa service. This feature allows guests to view offerings and make reservations. As with Shore Excursions, some apps allow guests to book these services shoreside as well.
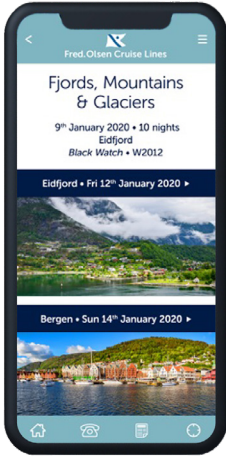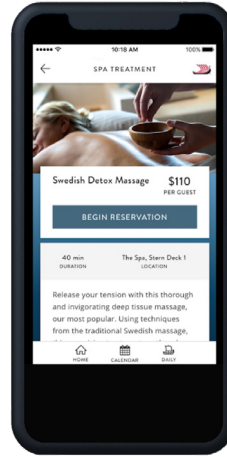
Less Common Features

The following features are available in at least three but no more than half of the apps we researched.
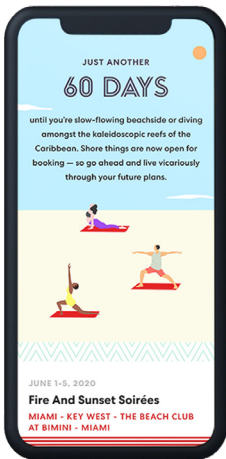
Countdown Clock

A pre-cruise countdown that works before boarding the ship is available on a few apps. This feature builds anticipation for the upcoming cruise, and some apps even allow users to share with friends and family.
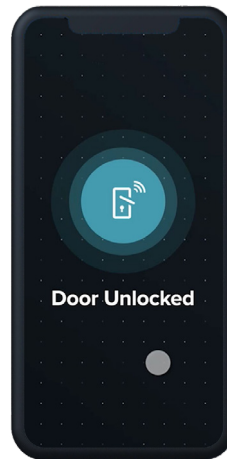
Digital Key

A few apps now allow guests to use their phone or a wearable (wristband, etc.) to unlock cabin doors, eliminating the need to carry keycards.
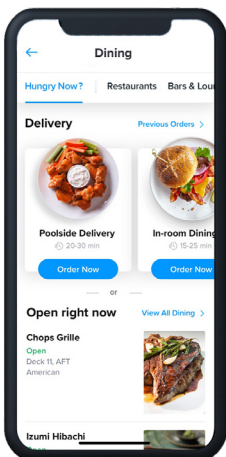
Mobile Ordering

Some apps allow guests to order food, beverages, and sundries for delivery to their staterooms or current location; others only enable ordering and payment for pick-up to avoid lines.
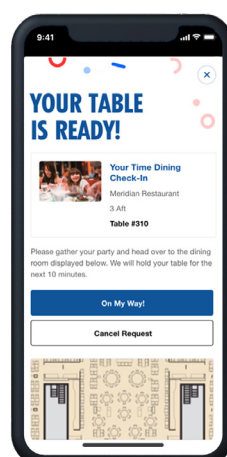
Virtual Queuing and Check-in New

A few apps allow guests to queue and check-in for entertainment, spa, and dining. Guests receive a notification when it's their turn, reducing long lines and avoiding large gatherings.
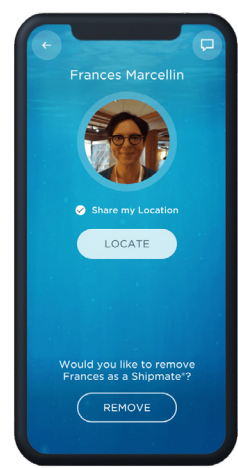
Wayfinding & Passenger Locator

A couple of the apps use a Bluetooth Low Energy (BLE) beacon system to help guests find their way around the ship.

Wayfinding and wearables are also making it possible to keep track of family and friends.

Stand-Out Features

Below are some of the unique features that stood out to us.
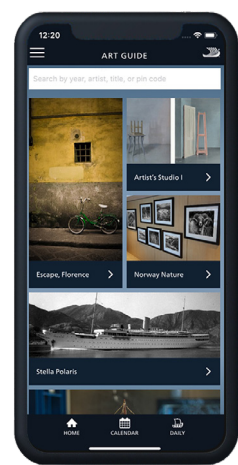
Art Guide

Viking Voyager includes the Viking Art Guide. Guests can listen to audio clips about historical pieces, works of art, and different areas of the ships.
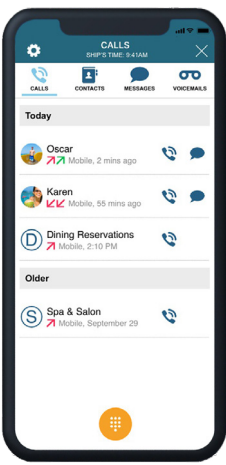
Guest Calling

Along with a chat system, Cruise Norwegian also has a call feature that allows guests to make unlimited calls to other passengers for a one-time fee of $9.95 (USD). Guests can also use it to call home for $0.79 a minute.
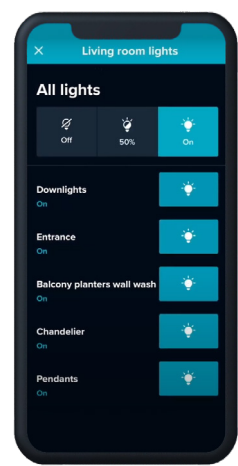
Stateroom Automation New

On some ships, Celebrity's app controls the TV, lighting, temperature, and shades.
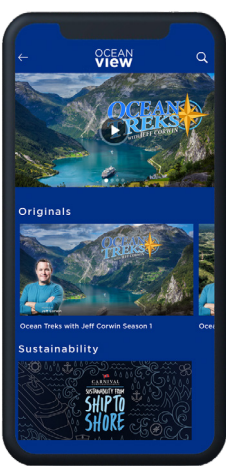
Video on Demand

A few of the guest-facing apps feature the cruise line's own channels and shows that do not require a supplemental app to watch.

Update Frequency

Once an app is live, regular updates are important. As operating systems are updated and new hardware devices are released, software has to adapt. Although the frequency of version releases is not indicative of the quality of an app, it does give us a general idea of how often developers are fixing bugs, responding to feedback, and making improvements.

While 2021 was a year of public health-related integrations, app updates in 2022 reflect the willingness of cruise lines to tackle new challenges and continue to streamline and improve core features.

In addition to improving app stability and technology, updates in 2022 have added features related to onboard operational efficiency, communication, guest experience, analytics, touchless and paperless options, and health and safety.

App	Updates
Seabourn Source	29
Holland America Line	27
Virgin Voyages	22
Royal Caribbean International	15
Celebrity Cruises	14
Carnival Cruise Line	11
Princess Cruises	11
Viking Cruises	11
Costa Cruises	10
Hurtigruten	7
Disney Cruise Line	6
Norwegian Cruise Line	6
MSC	4
Fred. Olsen	2

Tools and Key Players

Accenture

We have found a few apps in testing that strongly suggested the multibillion-dollar consulting firm's participation in the programming. Accenture extensively publicized their involvement in the development of the Carnival Medallion project, and it appears to offer both full application development and the augmentation of in-house teams in the cruise space.

Accessibility

Accessibility features are continuing to appear in more of the most technologically forward apps in the industry. Accessibility features allow passengers with disabilities to use the apps more easily. These users may have their devices in accessibility modes that help them read, have text read to them, have images described, or work with additional assistive technologies. This is a welcome new addition to the cruise industry and has often been a distant afterthought for most development teams.

Adaptive Icons   `New`

While not a functionally interesting update, Android Adaptive Icons made their first appearance in 2022 in some cruise apps. Adaptive Icons are a new-ish format for Android icons in yet another attempt to standardize the look and feel of Android devices and their home screens.

Apple controls not only their software, but the hardware that it runs on as well. As a result, they can define the user experience across all devices. Google mainly controls the software aspect of Android (and even that statement is more complicated than the scope of this study). Due to the limited control over the interpretations that hardware manufacturers have allowed in the Android world, icons have been inconsistent in look and feel (to say the least).

Adaptive icons allow developers to upload their app icons in a number of layers. Components like the background are separated from the icon mark. This separation allows the operating system customizations each manufacturer has chosen to standardize their look and feel with a number of masks that are applied dynamically.

Alipay & WeChat Pay

The inclusion of libraries supporting both Alipay and WeChat Pay continue to show the importance the industry is placing on the Chinese market.

Mobile wallets from Tencent (WeChat Pay) and Alibaba (Alipay) have become the norm in China. These systems largely dominate in China, accounting for 92% of market share and are rapidly turning the country into a cashless society. These integrations are presumably used for connecting credit cards or financial institutions to onboard folios as part of the check-in process or to be linked to direct onboard purchasing and casino transactions.

Artificial Intelligence

[Kore.ai](#), a virtual AI assistant system, has now been seen bundled into applications, and at least three cruise lines are experimenting with virtual chat assistants. These bots are commonplace on the web and are growing in shipboard applications. This is mainly due to the lack of on-premise solutions and data infrastructure. Virtual assistants need to be trained and conversations built on top of readily available data sources and APIs. If the data required to answer questions about the weather tomorrow is in a different system from the one required to make dining reservation inquiries, the development of AI systems becomes prohibitively complex.

Virtual voice assistants like MSC's Zoe platform were bespoke builds. However, with the increasing sophistication of onboard middleware products, it will become easier and more cost-effective to integrate pre-built AI systems into existing mobile apps.

ASSA ABLOY

[ASSA ABLOY Global Solutions Marine](#) (formally VingCard) is by far the leading provider of cabin door lock systems in the cruise industry. Mentions of their libraries have been spotted in a number of cruise apps in the past, but full implementation has seemed elusive. Two mobile apps have now been seen to include the full SDKs, although it is difficult to know the full level of integration. These SDKs would allow guests to use their phones to access the gangway and unlock their cabin doors.

Even though the technology to enable these convenient lock systems is available on many ships, it has yet to be widely rolled out. This may be due to several factors:

- The certifications required to work with the SDKs involve in-person ASSA ABLOY training, often in Northern Europe.

- Integration requires a fairly robust understanding of security systems and may be more challenging than standard mobile app development.

- Gangway systems and door lock systems may be from different suppliers. This means that generating a soft key would enable a passenger to unlock their door, but not access the ship. Having a passenger carry a keycard and a phone defeats the purpose. Integration with two separate systems also dramatically increases development complexity.

- Card printing systems may be run through separate integrations with the PMS, creating issues for developers who would have to manage both access control and card printing at the same time (rather than simply rolling out a soft key option).

ASSA ABLOY's SDKs in Android binaries strongly suggest that this will soon change.

Augmented Reality [New]

Augmented Reality (AR) is not new for 2022, but the use of the native OS AR development tools is interesting to see. Previously, cross-platform AR systems have primarily used third-party libraries to include AR features, but this seems to have shifted to native-level tooling. ARKit (iOS) and ARCore (Android and some cross-platform availability) have now been spotted in the wild in their native environments. Right now, these AR systems are used for adding fun or "cool factor" features like

virtual x-ray vision systems onboard, which allow users to see through virtual windows into other parts of the ship. However, more informative applications such as wayfinding, self-guided tours, geographical contextual information, and in-cabin assistance are just a few of the applications cruise lines are already exploring for the future.

Beacons & BLE

Bluetooth Low Energy (BLE) beacons allow a Bluetooth-enabled device (such as a smartphone) to detect small radio devices nearby. These devices send out an identifier that the detecting device can send back to a central server to learn more information.

Up until 2020, the level of support for beacon functionality was increasing. The use of technologies such as the [Android Beacon Library](#) indicated that cruise lines were making significant investments in the infrastructure to enable this tech onboard.

A few cruise lines have dropped support for BLE over the last two years. There are a number of possibilities to explain this:

• Analytics were showing that passengers were uncomfortable allowing their devices to hand over Bluetooth permissions to cruise lines. This may be due to bundling too many permission requests in a single ask and scaring the guests off from accepting anything. It also may have been a privacy concern for the users.

• BLE technology onboard ships has been difficult to implement. Signals do not pass well through steel bulkheads and fireproofed walls. Experiments where beacons were attached

to tables to allow instant drink ordering were sometimes unsuccessful because passengers and crew moved tables around. BLE may not be as practical on a real ship as it is in a lab environment.

Booking Cancellations   *New*

Booking Cancellations have appeared in cruise apps in the past, however they were removed in later iterations. As far as our research has found, the reason for this removal was operational and not technical. A number of PMS providers' systems have API calls that allow for booking and cancellations of restaurant and shore excursions. Spa bookings are less well-supported, but are improving.

At least one known issue in previous cancellation features was due to the business logic of the applications, which allowed passengers to cancel reservations outside of the cancellation policy of the cruise line. This issue was due to the fact that the PMS's business logic for policy control did not extend to the API. As a result, guests could cancel a shore excursion minutes before departure time, well after manifests for the tour guides and coach drivers had been printed. This logic has now been implemented on the app side.

Braze   *New*

[Braze](#) is a marketing automation and customer engagement company that went public in November of 2021. Braze offers a number of customer messaging tools, including email, text messages, and in-app notifications. These messages are typically triggered by either scheduled events or

through API events. For example, an app user might get a push notification reminding them to reopen the app after three days of no use, or they might get an email after the 20th time they checked the weather in the app. Only one cruise app currently uses Braze's tools, and we speculate that these are primarily used for pre- and post-cruise messaging.

12:00

<   DINING   ☰

Soup and Thai Casual Diner

Thai & Vietnamese

11 a.m. – 2 p.m. & 5 p.m. – 11 p.m.

View on Map   View Menu

RESERVE

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Bug Tracking & Analytics   *Updated*

Debugging and troubleshooting cruise apps in a production environment is a challenging task. Shoreside test systems data are problematic throughout the industry. Not only have PMS systems become massively complicated, but there are also a myriad of onboard scenarios that are not often accounted for in testing. Couple these facts with the increasingly large number of devices that guests are bringing onboard, and you have a QA person's nightmare. When issues are reported back to the shoreside IT or Software departments, it can be very difficult to recreate the issue, let alone solve the problem.

These difficulties explain the new addition of Instabug. Instabug is a crash and bug monitoring tool that can tell developers exactly which line of code caused a crash. It can also allow users to report bugs themselves, directly though the app. User crash reports can arrive bundled with screenshots or even videos of the user's behavior before a crash. While this might be a privacy concern to some guests, these features may or may not be turned on.

Also new for 2022 was the addition of Sentry, an advanced crash monitoring tool with stack tracing built in. Sentry's tools allow developers to be alerted to the specific module, or even line of code, that caused a crash. Sentry can also monitor the speed of certain functions, allowing developers to optimize their applications based on data from the tool.

Firebase is still the most popular crash and error reporting tool in the industry. This tool unifies the crash reporting and user analytics (device types, user demographics, mostused sections of the app, etc.) in one dashboard for developers to monitor.

Firebase is now being used in conjunction with additional tools, such as Sentry, for added insights into onboard issues.

Dynatrace is another new analytics and application performance monitoring tool. Dynatrace provides an on-prem solution, which is unusual for these types of applications, making them ideal for cruise ships.

Card Scanning

Card scanning applications and libraries are embedded into cruise apps to allow passengers to scan credit cards, driver's licenses, or passports to speed up the check-in process.

Microblink seems to be the primary choice in embedded card-scanning SDKs. BlinkID and BlinkCard allow developers to capture ID documents and credit card information from device camera scans.

Charles

A common challenge while developing mobile applications for cruise lines is the debugging of issues discovered. No amount of logging and exception logging is the same as a developer being on the ship and experiencing the issue firsthand. Replicating the same issue locally might be difficult due to a variety of services not available in a test environment. Charles works by allowing a developer to proxy onto the ship to test the issue directly on a real device. We discovered a number of applications that contain a Charles SSL certificate, hinting towards multiple cruise lines using this type of debugging.

Cruise Director (Sourcetoad)

Sourcetoad's Cruise Director is a suite of onboard and shoreside software tools designed to manage various aspects of both guest-facing and crew-facing applications.

Cruise Director contains out-of-the-box modules for entertainment (i.e., iTV and music), intelligent signage, captive portal, mobile app management, IoT device management, cabin access, and notifications. Custom modules are easily added to enable interfaces for new technologies, dashboards, and features.

The framework is built on shared API management, shoreside synchronization, content management, and analytics across the suite. This allows all modules to have a cohesive interface, which can be managed from a shoreside office, while sharing data with other modules and funneling data into a combined analytics system.

Developers

Analyzing the apps provided insight into the development teams behind the code. Package names and test account information were often clearly visible; however, it is problematic to make assumptions about developers unless it is quite obvious. Developer vendors can provide external libraries that cruise internal teams ingest into the in-house codebase to add an out-of-the-box feature. External development teams may also be augmenting in-house developers with outside vendors.

Exo Media Library `New`

Exo Media Library is an Open Source Android media player add-on maintained by Google. Although it's not as efficient as the built-in Media Player, it can handle many more streaming standards. Typically, using the built-in operating system media player is good enough—or even better—than external libraries, but only for video content already on the device. Including an external media player, like Exo, in the app allows developers a number of benefits:

- The media player experience is typically much more customizable in the look, feel, and functionality.

- As new features become available, users need a simple app update, rather than updating their device's OS.

- The media playing experience will be the same, or at least much more similar, across devices.

The inclusion of this library points to at least one cruise line adding streaming video to their app. This content might be movies, live TV, or events and performances.

Digital Rights Management for streaming studio-owned content to personal devices is still a challenge onboard—unless of course the cruise line is owned by a studio.

External Settings Files

Cruise applications have an uncommon constraint: they act differently based on the network you have joined. The idea of the application acting differently automatically requires a solution that works without the guest noticing anything. An external settings file works by requesting a file from a specific domain with configuration flags. Once connected to the onboard network, this file will return different flags than it will return when connected to a standard internet connection. This can be expanded greatly to include more than simple configuration flags. We noticed this pattern of development in many of the applications.

Fingerprint Authentication

Biometric authentication systems such as Face ID and Touch ID have become commonplace in many mobile apps. However, they have not been widely implemented in cruise apps. In fact, we found only one app featuring fingerprint authentication.

Biometrics are useful for systems that automatically log their user out for security purposes. Not having to reenter a password over and over again is also more convenient. Considering that most cruise apps have fairly low security implications, they typically rely on a token system to keep passengers logged in during the duration of their cruise. As a result, we think that biometric authentication will not become the norm anytime soon.

Flight Track Information `New`

Three industry apps now support some level of flight tracking for guests. These features all focus on post-cruise flight information tracking. By combining guest PMS travel information with flight status data from 3rd party providers, passengers can anticipate their return travel plans. Flight delays can drastically change airport transport fees, wait times, and frustration levels, especially when internet access is limited. Having a centralized, app-provided pathway for these data can improve the guest experience significantly. Readily available guest access throughout a mobile

app also reduces the number of calls and wait times on guests services on debarkation days when traffic is typically highest.

Food Pickup New

Delivery options onboard have been around for a few years, but it now appears that at least one cruise line has implemented a pickup option for certain restaurants. This pickup option essentially works as a carry-out service; the user can place an order in the app before arriving at the restaurant to pick up the order to-go.

Hermes New

Two React Native apps have switched to using the Hermes JavaScript engine. This engine moves more of the work done by an app to the build time, rather than the run time. Basically, this means more of the app is pre-compiled, leading to the app loading and running faster, as well as having smaller app download sizes. Depending on the complexity of the application, this could have been a fair amount of work for the development teams.

Image & Animation Libraries

Our research shows that libraries like Glide Transformations, React Native Animatable, and ViewAnimator are still being used to make apps a more fun, lighthearted experience for users.

Liferay

Liferay is an open-source enterprise CMS. We found that at least two cruise applications were using some part of Liferay DXP, the company's digital experience platform, most likely to deliver marketing content and images to the app. Liferay is also likely being used as an EFSS (enterprise file synchronization and sharing) tool to coordinate shoreside digital assets for synchronizing to onboard systems.

Medallia

Medallia is a platform technology that analyzes feedback from social media sources and review sites. They now also offer their own set of mobile feedback tools that can be embedded in applications, which is presumably how it is being used in at least one of the cruise apps we investigated.

netTALK

netTALK Maritime provides a number of telephony, device tracking, and health-related SDKs for cruise mobile development. netTALK has traditionally provided telephony and chat services onboard, but the COVID-19 crisis saw them expand with a number of innovative health and safety offerings.

Night Mode Support New

A small, but interesting update for two applications was support for Night Mode. Night or Dark Mode is the ability for a device's applications to show darker backgrounds during low light conditions, which helps reduce eye strain at night. Cruise apps are typically heavily styled and branded when compared to your standard business application. As a result, more components are hand made, rather than using the standard operating system components.

Standard OS components make night mode integration easier for developers, as it generally comes standard with the module. It is possible that the addition of Night Mode in these applications was part of a framework upgrade where Night Mode

was included, rather than a development priority, but it's an interesting feature to see in the industry either way.
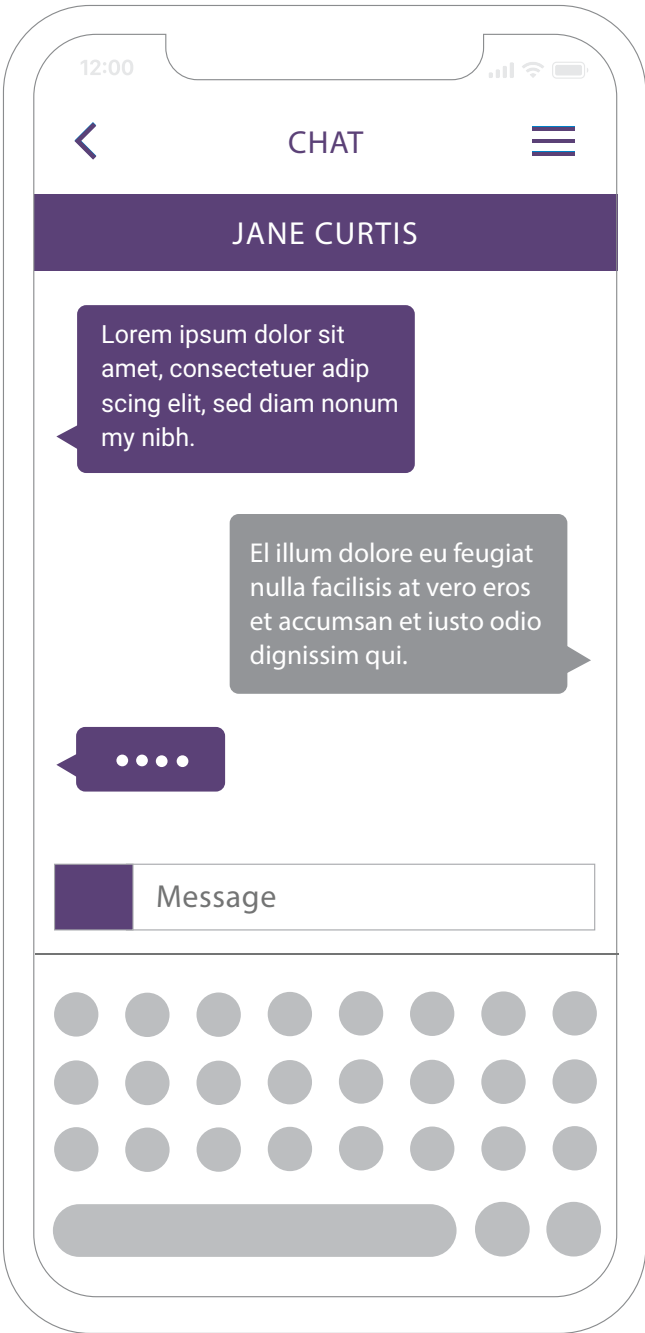
Notifications New

Notifications might be the most interesting developments in our 2022 App Report. As a result, we should start with a few definitions.

Remote push notifications are familiar to most people as they have been around for a while. These are notifications triggered by a server on the internet creating an alert that is sent to a notification relay run by Google or Apple. To do this on Android, a request is made to Google Cloud Messaging (GCM) which then forwards the message to the device. Apple has Apple Push Notification service (APNs), which works in basically the same way. Remote push notifications are great when devices are connected to the internet, but they have limitations in the cruise industry.

Background push notifications are messages that a device can send its owner independently. These come in a few flavors:

- Polled messages, where the app makes a request to a server every now and again, and checks to see if there is a message waiting. This works on local servers but it's not instantaneous, and it can poll up to an hour at a time if the device's battery is low. Polled messages are great for tasks like reminding passengers what port is next, or that they have a spa reservation on Thursday.

- Local app notifications are when the app itself (not a server) sends a message to the user. This is often based on a timed event, such as "You're

dining reservation is in one hour." In this case, the app has stored the time of the event, knows what time it is now, and sends the notification based on internal logic. The problem with this on a ship is that ship time and device time often differ. Messages are usually only off by an hour, but that's enough to confuse a guest, so messages must be more vague and less useful.

- In lieu of using remote push, two cruise lines have used a novel websocket notification to send messages to passengers. This is similar to having the app open a browser tab that is hidden from the user and then using the open connection to message everyone on the ship at the same time. These connections appear to be for tasks such as alerting all passengers that mustering will start soon, or other ship-wide notifications.

Local push notifications were introduced in 2020 by both Google and Apple. This new feature allows developers to build push notification servers on local networks (with some special permissioning). Essentially, these servers can mimic the functionality of the remote push systems. Local push means that a cruise director could theoretically write a small message inside of a web console to notify anyone who had opted-in that a pod of whales has been spotted off the port bow—in real time!

In our 2021 report, we predicted that Local Push was going to expand widely across the industry. In fact, only one cruise line has incorporated true local push notifications to date. The lack of implementation might be due to the fact that the technology is very new and very little has been written about it. As a result it might just be too experimental or obscure for some companies to want to try.

The benefits to a true Local Push system are less on the app side an more on the infrastructure side. Having a Local Push system inside of a cruise's services might allow for much more intelligent messaging across devices and methods, as well as having deeper analytics and read responses.

Notification Centers are also now in at least two applications. These are centralized messaging hubs inside of the mobile apps that show previously read messages. One variation of this was a digital survey system that allows passengers to see surveys they have already completed.

PDFium

[PDFium](#) is a Google-supported, open-source library for manipulating PDFs. It allows developers to view, print, search, and fill out PDF forms. Managing PDFs has largely been handled by server-side applications rather than on passengers' actual devices. We can assume that the inclusion of this library at the local level is to handle PDF documents (e.g., tickets, medical forms, etc.) in an offline environment.

Pre-arrival checklists   *New*

Pre-departure checklists were first seen in cruise apps in 2017. These mainly focused on pre-populated to-do lists for what to bring in a guest's luggage or the paperwork they required. For some reason, these features completely disappeared from the two or three apps that offered them by 2020. However, after a short hiatus, they're back with a twist. Pre-arrival checklists now focus purely on health and safety, mainly around COVID-19 precautions. The checklists come in three versions:

- **Vaccination checklist questions.** "Have you had a booster shot?" or "Have you uploaded your vaccine card to the pre-departure system?"

- **Testing.** "Are you aware that you will need to take a Covid-19 test every morning on your cruise?"

- **Health and Safety.** "Have you had a fever over 101 in the last week?"

ProGuard

[ProGuard](#) works like many obfuscation tools by optimizing the Java bytecode. This tool is joined by many on both Android and iOS for the purpose of optimization and security protections at the application level. The benefit being that any prying eyes have a lot more work to do instead of looking at bytecode equivalents of the protected source code of each application.

SQL Cipher   `New`

[SQLCipher](#) is an open source extension to SQLite—the most common database engine built into smartphones and devices. It adds 256-bit AES encryption to a SQLite database, making them significantly more secure.

SQLite itself is not secure. If you store text in a SQLite database, you should assume anyone with access to the device has access to the text. So why would a cruise line want to encrypt their database on a user's device? Our top assumptions for doing this are:

- A general security improvement to the application brought on by regulations inside of large organizations.

- The application is now storing payment or credit card data, and there are regulations around how this data is stored at rest.

- Health and safety protocols require collecting personal health data which cannot be stored in un-encrypted databases.

Storing encrypted data on a mobile device is not a bad idea in general, and the drawbacks are limited to some very minor performance losses when writing

data. As a result, the pros largely outweigh the cons. However, having personally identifiable information (PII), payment info, or health data on a device is still a security risk, and could be managed with tokenization and well-architected server access.

Technology Blends   `Updated`

In the last four years, the technologies used to build cruise apps have greatly diversified. In 2019, almost all apps analyzed were predominantly native, meaning they were written in Java or Kotlin for Android platforms, and Objective-C or Swift for iOS platforms.

Two mobile apps are now using [React Native](#) as their core technology. React Native is an open source, Facebook-supported technology that is used heavily throughout the app building world, including companies like Instagram, Uber Eats, and Shopify. It allows developers to use JavaScript to build a single code base that will compile to both Android and iOS.

Two mobile apps are now being built with [Cordova](#). Cordova is another cross-platform technology that essentially allows developers to write code using standard web development tools (i.e., HTML5 and JavaScript), and then run that code in an app wrapper. This is similar to most interactive TV development, where the application runs a headless browser and then loads the web content into the frame—another unusual choice for a cruise app. Development time and complexity are significantly lowered, with the trade-off coming in terms of speed and functionality.

One new app for 2022 has been built using Xamarin. Xamarin is a commercial extension of Microsoft's popular .NET development platform.

It allows Microsoft developers to share up to 75% of their code across platforms in order to build cross-platform applications for Android, iOS, tvOS, watchOS, macOS, and Windows.

Only one of the cruise applications investigated was built using Unity. Unity was primarily developed to be a hybrid 3D gaming engine. There have been a number of non-gaming mobile apps built with Unity, but it is still an outlier as far as development choices go. The Unity engine does allow for more radical interface designs, as well as a single code base to be deployed across iOS and Android devices.

TensorFlow   New

Inside of one application we discovered a number of TensorFlow SDKs. TensorFlow is an open source platform for machine learning (ML). It allows developers to build ML models for a number of applications on mobile devices, the web, and as a service.

While it is not yet possible to know the exact usage of TensorFlow's systems inside the mobile apps, we can speculate on a number of use cases. Edge-based ML models could help with:

- Making recommendations to guests about other activities they might like.

- Assisting in speech recognition systems for adding voice assistant functionality.

- Recognizing and categorizing certain types of uploaded images and videos for sharing onboard or for crew to find maintenance issues.

- Monitoring the language used inside of chat systems with crew.

- Building smart bot systems for responding to

guests with workflow automations for common requests.

- Object detection paired with help and manuals. For example, a guest could point their device around their cabin, and the device would recognize the telephone and provide the guest with instructions on its use.

Test Data/Shim

Many of the apps we researched included test, or "shim," data inside of them. This is basically a text file containing a fake passenger's details, calendar, folio, and any other items needed for testing. This shim data will also include items such as restaurant menus, available spa treatments, and shore excursion offerings. The reason the data is included in the actual app is so Apple (or other testers) can test the app without connecting to a PMS (property management system) or shoreside test databases. The risk with this data remaining in the application is that it could expose vectors of attack for hackers by providing insight into other onboard operations.

Test Logins

About half of the apps we investigated contained clear text usernames and easily visible passwords. This might sound more alarming than it actually is, but it is interesting to note. These credentials are for testing purposes, specifically for Apple's testing. Unlike the Google Play store, which relies solely on automated tests, Apple has real people testing the apps. Because most cruise apps are designed to only work shipboard, testers need a way to trigger "onboard mode" with fake credentials

to log in. Of course, this leaves open the possibility that someone other than approved testers could log into the apps without having to pay for a ticket to board the ship.

Virtual Queuing and Waitlists *New*

A few cruise apps are now showing evidence of a long-awaited feature: virtual queuing.

The virtual queuing systems work by asking guests to sign up for an event, a service, or even an overbooked excursion inside of the app. This is often prompted at the event location itself by a piece of signage and a QR code. The app then sends a notification to the guest when their turn has come.

Virtual queuing is available for activities such as rock walls and games, but also night clubs, restaurants, and even disembarkation. Online passenger forums, however, are often negative on this feature, with complaints mainly focusing on the inconsistency of the functionality. Some guests have commented that notifications have not been delivered, or they were "in queue" for over 24 hours. These types of issues are not unexpected in new features, but can be frustrating for passengers. However, once these bugs are worked out, virtual queuing will allow for a much safer, streamlined experience onboard.

Wallet Support *New*

Another interesting feature added on the payment side this year has been the addition of a wallet function in one of the apps. The wallet feature allows users to store their payment information inside the mobile app itself, and not just the OS-level payment wallet. This is an unusual step as onboard payments typically work by making an API to POS or

PMS folios, rather than taking the effort of handling the complexity and compliance in-app. However, this feature was likely a carry over from the brand's other ventures, and so was less of an effort.

WebP *New*

WebP is a modern image format that provides superior lossless and lossy compression for images on the web. Using WebP, webmasters and web developers can create smaller, richer images that make the web faster.

WebP lossless images are 26% smaller in size compared to PNGs. WebP lossy images are 25-34% smaller than comparable JPEG images at equivalent SSIM quality index.

Rating Our Predictions From 2021

Increased Digital Delivery

In 2021, we predicted that more cruise lines would shift away from printed materials in favor of digital. We suggested that cruise lines would seek to improve hygiene onboard, cut down on printing costs, and save the time it takes to distribute paper-based materials to passengers by shifting to touchless and digital delivery systems. Currently, several cruise lines have gone close to totally paperless, and many are now using digital delivery for most of their communications. We have also seen a large number of onboard menus go from paper-based to QR code-based. Although there are still cruise lines that distribute printed tickets, menus, and daily newsletters, paper-only has quickly become the minority.

Score: 8/10

Shoreside & Shipboard Convergence

Last year, we observed that most cruise apps focus solely on the onboard experience, leaving pre-cruise and post-cruise as opportune areas for future development. This year, we are seeing more cruise lines roll out pre-cruise features, such as excursion booking, meal reservations, and cruise countdowns, but the post-cruise area remains largely unexplored.

Score: 6/10

Digital Mustering for All

We predicted that in-person mustering for safety drills would give way to fully digital versions to streamline the boarding experience and eliminate a pain point for both crew and passengers. We also predicted that digital solutions would take over other areas, such as check-ins and shore excursions. This year, online pre-registration and staggered check-ins are increasingly common features, along with the option to book shore excursions and other services digitally. Although many apps are now offering digital mustering features, very few are fully-digital: most are hybrid solutions that still require an in-person component.

Score: 5/10

A New Era for Push Notifications

We predicted that last year's release of new local push notification systems on Android and Apple would help usher in a new generation of onboard app features across the cruise industry. While the lack of a consistent internet connection was previously a huge challenge for ship-wide push notifications, we are now seeing a large number of apps roll out a variety of onboard notifications. Chat features have quickly become standardized across the industry, so push notifications have greatly improved their onboard functionality. Instant notifications for virtual queueing, dining reservations, reminders for ship activities, and health and safety announcements are also growing in popularity thanks to the improved push notification systems. Surprisingly, reliance on the new local push systems from Apple and Google
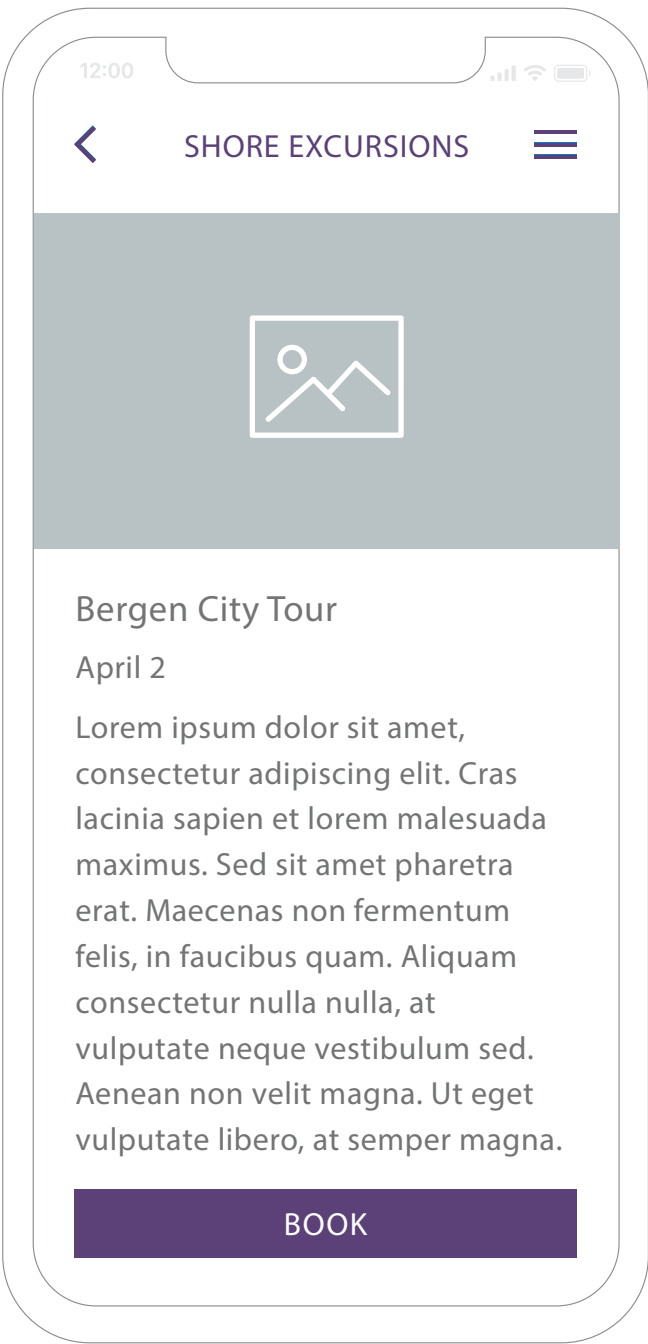
is not the route that most developers have taken. As a result, notifications are less reliable than they could be, and guest reviews have highlighted this as an area for improvement.

Score: 7/10

Health-Related Changes

Finally, we predicted ongoing focus on pandemic-related health measures. Since a majority of cruise lines require guests to be fully vaccinated, we suggested apps would add functionality for completing pre-board screenings and uploading health documents, such as vaccine cards and COVID-19 test results. Our research found that a majority of apps now include pre-arrival features for uploading proof of vaccination, completing health and safety questionnaires, and acknowledging that daily COVID-19 tests are required.

Score: 9/10

12:00

SHORE EXCURSIONS

Bergen City Tour

April 2

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BOOK

Looking Ahead

New Entries

Surprisingly, there are still a few notable cruise lines missing from the app stores. Particularly lines with older passenger demographics have been slow to adopt onboard mobile apps. However, the world has changed to a point where we anticipate having at least two new apps to examine in next year's report.

Rewrites

Given the increasing number of mobile technologies, we predict that at least one or two apps will be completely rewritten from the ground up. The constant updates and features of any technology project often lead to large amounts of "technical debt" making it harder to work with old code bases. On top of this, there are new technology offerings that might make development easier for a team to build a mobile app from scratch. This leads us to suspect that some software engineering departments might shift their efforts to a new set of platforms.

Continuing the Medical and Health Integrations

While almost every app in the market added a health survey of some sort in the last year, we predict that additional development will continue in the space. The global COVID-19 pandemic is not over, and any interruptions in service sparks fear in the media and a dip in sales. Continuing to make passengers feel safe, increasing reaction speeds to outbreaks for medical staff, and generating more data about how to cope with outbreaks are all priorities for development teams and operational staff.

Increased Shoreside Functionality

This year we are doubling down once again on the prediction that booked-not-departed and post-cruise features will be added. Enhancing the guest experience in native app environments is a great way to make mobile apps stickier and ensure guests have pre-downloaded them. Post-cruise features will allow for more frequent guest communication and new messaging channels through which to push sales and marketing offers.

The Beginning of the End of Onboard Print Materials

Onboard printing of daily newsletters and tickets is not only a cost center, but a health and safety issue as well. Moving these items to the digital realm, or at least requiring an opt-in from guests, could save cruise lines millions of dollars in paper, ink, and fuel. There is resistance from some guests who miss the feel of paper, but providing opt-in solutions for these passengers can reduce frustrations.

Conclusion

Spotting large trends in the Cruise App market has become increasingly difficult this year. 2019 saw many lines launching development initiatives to build out a number of common features. 2020 saw development drop significantly as investment in the industry was significantly reduced in uncertain times. 2021 was the year of adding touchless systems and medical integrations.

2022 has been a year of interesting innovations and challenges, but with more in common with 2018 than with 2021. Cruise lines appear to be willing to take on new and interesting challenges this year, and we predict this will continue on into 2023. As core, expected features stabilize across brands, development departments and agencies will focus on niche features for their particular demographic, or interesting tools for competitive advantages.

COVID-19 is still a driving force in new development, but it is no longer the only driving force. As with many industries, the pandemic has only increased the speed of digital initiative. Cruise lines have added features around health and safety, operational efficiency, guest experience, communication, paperless and touchless options, and tracking and analytics systems. At the same time, a lot of work has been done on stability and technology enhancements, which shows that development teams are getting better at balancing feature requests with maintenance and support.

While app technologies have diversified and improved, many of the underlying systems appear unchanged. There were no new development players spotted, nor were there any new Content Management Systems found. This may change over the next year, but for now we know that more change is occurring at the app development level than at the marketing department level.

This has been an exciting year of innovation in the cruise app world. There have been a wide range of improvements, features, and technology choices. We can't wait for what will be a fascinating year of continued modernization and creativity in an increasingly diverse set of offerings from cruise lines and their development teams.

About Sourcetoad

Sourcetoad is an award-winning software and app development firm committed to the co-creation of technology solutions that solve complex business problems, delight users, and help our clients achieve their goals.

For nearly 15 years, our team of U.S.-based in-house experts have managed the design, production, deployment, and maintenance of over 275 custom software projects for clients across a variety of industries, including hospitality, education, financial services, and healthcare. Collaboration, humility, and joyfulness define our culture and fuel our creativity; we become part of each client's team as we bring purpose-built software to life, together.

We are headquartered in Tampa, Florida with additional offices in Perth, Australia.

Learn more at Sourcetoad.com.